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IN THE UNITED STATES
PATENT AND TRADEMARK OFFICE

PATENT APPLICATION

Mehmet Oguz Sunay

CASE 2

TITLE Code Space Sharing Among Multiple Modes Of Operation

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

NEW APPLICATION UNDER 37 CFR § 1.53(b)

Enclosed are the following papers relating to the above-named application for patent:

Specification
3 Informal Sheets of drawings
Assignment with Cover Sheet
Declaration and Power of Attorney

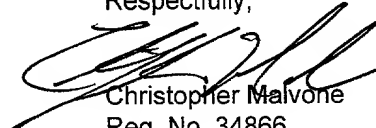
CLAIMS AS FILED				
	NO. FILED	NO. EXTRA	RATE	CALCULATIONS
Total Claims	14 - 20 =	0	x \$18 =	\$0
Independent Claims	2 - 3 =	0	x \$78 =	\$0
Multiple Dependent Claims, if applicable			+ \$260 =	\$0
Basic Fee				\$690
			TOTAL FEE	\$690

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The Assistant Commissioner for Patents is hereby authorized to treat any concurrent or future reply, requiring a petition for extension of time under 37 CFR § 1.136 for its timely submission, as incorporating a petition for extension of time for the appropriate length of time if not submitted with the reply.

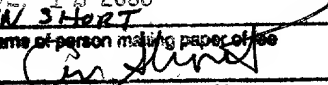
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Respectfully,


Christopher Malvone
Reg. No. 34866
Attorney for Applicant

SEP 12 2000

Date: _____

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**CODE SPACE SHARING AMONG
MULTIPLE MODES OF OPERATION**

Related Applications

5 Related subject matter is disclosed in the following application filed concurrently herewith and assigned to the same assignee hereof: U.S. Patent Application entitled "Dynamic Reassignment Of Code Space Among Multiple Modes Of Operation", Serial No. ____.

Background of the Invention

10 **1. Field of the Invention**

 The present invention relates to communications; more specifically, wireless communications.

15 **2. Description of the Related Art**

 In some wireless communication systems, channels are distinguished using orthogonal codes such as Walsh codes that are assigned from a collection of codes that constitute a code space. Typically each user is given full time access to a subspace of the code space such as one or more Walsh codes. This type of use of the code space is inefficient in multiple mode
20 operations such as in systems supporting both voice and data users.

Summary of the Invention

 The present invention divides the code space associated with the communication system into two subspaces where each subspace is assigned to a different mode of operation. In one
25 mode, such as a voice mode, each user is given full time access to a portion of the subspace associated with that mode of operation until the communication session is ended by, for example, a handoff, a dropped call or an end of call. In a second mode, such as a data mode, each user uses the entire subspace associated with that mode on a time shared basis.

30 **Brief Description of the Drawings**

 FIG. 1 illustrates Walsh matrices;

 FIG. 2 illustrates a Walsh matrix of order 4;

 FIG. 3 illustrates the derivation paths for different Walsh spaces;

FIG. 4 illustrates the relationship between portions of a 128 Walsh code code space; and
 FIG. 5 illustrates the distribution of code space between two modes of operation.

Detailed Description

Walsh codes have the distinctive property that higher Walsh space codes can be derived from the lower Walsh space codes.

FIG. 3 illustrates a Walsh matrix of order 1 and order 2, and a Walsh matrix of order $2n$. The rows of the matrix are the Walsh codes composing the Walsh space. The relationship between a Walsh matrix of order n and order $2n$ is a recursive relationship and is used to easily produce larger order Walsh matrices. For example, in creating a Walsh matrix of order 4, the Walsh matrix of order 2 is inserted into the upper left hand corner, the upper right hand corner, and the lower left hand corner of the Walsh matrix of order 4. The bar version of the Walsh matrix of order 2 is inserted into the lower right hand corner of the Walsh matrix of order 4. The bar version of the matrix is formed by taking the logical inverse of each element of the matrix.

FIG. 2 illustrates a Walsh matrix of order 4.

Orthogonality across codes from different spaces is possible as long as two codes that are in the same derivation path are not selected simultaneously. Consider FIG. 3. Here, a code from the Walsh space of Walsh-16 is used to derive two codes from the Walsh space of Walsh-32. Likewise, each Walsh code from the Walsh-32 space is used to create two codes from the Walsh-64 space and so on. In the figure $W_{x,y}$ represents the y 'th Walsh code form the Walsh space of Walsh- x . Now, from the figure, one can see that, for example, while $W_{32,1}$ and $W_{64,3}$ are orthogonal, $W_{32,1}$ and $W_{64,2}$ are not.

When assigning code space to mode one users, such as voice users, and assigning other code space to mode two users, such as data users, it is desirable to divide the codes in large blocks that originate from a lower order Walsh code such as a 16 symbol code. By assigning the subspaces in groups originating from lower order Walsh codes, a receiver's design is simplified by requiring fewer decoding paths to receive transmissions. For example, in a system using 128 symbol Walsh codes, it is desirable to assign the codes to the subspaces in groups of 8 consecutive codes so that a receiver would only need 16 decoding paths to receive transmissions.

In reference to FIG. 4, an initial set of subspace assignments may be with $W_{128,1}$ through $W_{128,8}$ being assigned to mode 1 operations while the remaining Walsh codes are assigned to the mode 2 (Walsh codes $W_{128,9}$ through $W_{128,128}$). It should be noted that the code spaces have been

divided into subspaces originating from 16 symbol Walsh codes which allows a receiver to use 16 decoding paths to receive transmissions. In the mode 1 subspace one or more codes are assigned to each user on a full time basis or until communications are complete with that user. In the mode 2 subspace, all of the codes are assigned to a single user on a time shared or time multiplexed basis. For example, each of n users may use the entire mode 2 code subspace for $1/n$ of the time.

It is also possible to distribute the codes among the mode 1 and mode 2 subspaces on a dynamic basis. For example, if one code in the mode 1 subspace is not being used, it may be assigned to the mode 2 subspace; however, this is subject to the code from the mode 1 subspace being orthogonal to all of the other codes in the mode 2 subspace. If more codes in the mode 1 subspace are unused, they may be assigned to the mode 2 subspace as well, but once again subject to the codes from the mode 1 subspace being orthogonal to all of the other codes presently in use in the mode 2 subspace. Similarly, unused codes in the mode 2 subspace may be assigned to the mode 1 subspace subject to the codes from the mode 2 subspace being orthogonal to all of the codes presently in use in the mode 1 subspace. Information regarding the current set of code assignments may be transmitted by a base station to users as well as other base stations using communication channels such as control channels or paging channels.

FIG. 5 illustrates the distribution of codes between the mode 1 and mode2 subspaces. Portion 10 may be assigned to the mode 1 subspace while portion 20 is assigned to the mode 2 subspace. It should be noted that a guardband 30 is provided where codes are not assigned to either subspace. This guardband allows the mode 1 or mode 2 subspaces to expand without immediately removing a code from the other subspace. After some of the codes in the guardband are assigned to one of the subspaces, the guardband is expanded to its original size by taking codes from either subspace as they become available. Additionally, each of the code spaces may be assigned a minimum number of codes indicated by bands 40. These bands guarantee that each of the mode 1 and mode 2 subspaces always have a minimum number of codes for operation.

The invention claimed is:

1 1. A method for partitioning code space in a communication system, comprising the step
2 of:

3 dividing a code space into at least two subspaces, where codes in the first subspace are
4 assigned to at least one user at a time for a communication session and where all of the codes in
5 the second subspace are assigned to one user.

1 2. The method of claim 1, wherein codes are dynamically assigned between the at least
2 first and second subspaces.

1 3. The method of claim 2, wherein a minimum number of codes are provided to the first
2 subspace.

1 4. The method of claim 2, wherein a minimum number of codes are provided to the
2 second subspace.

1 5. The method of claim 2, wherein a plurality of codes are unassigned to a subspace and
2 are available for assignment to either subspace.

1 6. The method of claim 1, wherein the first subspace is used for voice communication.

1 7. The method of claim 1, wherein the second subspace is used for data communication.

1 8. A method for partitioning code space in a communication system, comprising the step
2 of:

3 dividing a code space into at least two subspaces, where codes in the first subspace are
4 assigned to at least one user at a time for a communication session and where all of the codes in
5 the second subspace are assigned to one of a plurality of users on a time shared basis.

1 9. The method of claim 8, wherein codes are dynamically assigned between the at least
2 first and second subspaces.

1 10. The method of claim 9, wherein a minimum number of codes are provided to the first
2 subspace.

1 11. The method of claim 9, wherein a minimum number of codes are provided to the
2 second subspace.

1 12. The method of claim 9, wherein a plurality of codes are unassigned to a subspace and
2 are available for assignment to either subspace.

1 13. The method of claim 8, wherein the first subspace is used for voice communication.

1 14. The method of claim 8, wherein the second subspace is used for data communication.

Abstract of the Disclosure

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FIG.1

$$W_1 = [+1]$$

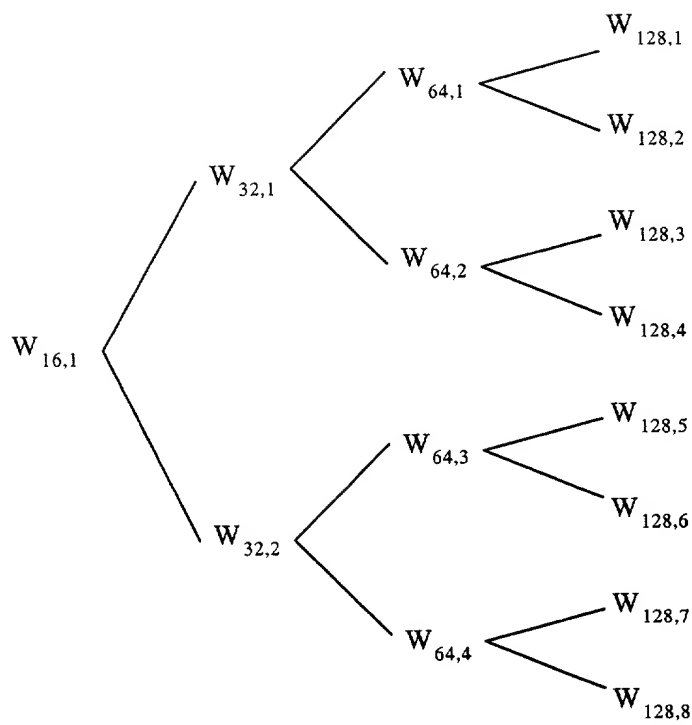
$$W_2 = \begin{bmatrix} +1 & +1 \\ +1 & -1 \end{bmatrix}$$

$$W_{2n} = \begin{bmatrix} W_n & W_n \\ W_n & W_n \end{bmatrix}$$

FIG.2

$$W_4 = \begin{bmatrix} +1 & +1 & +1 & +1 \\ +1 & -1 & +1 & -1 \\ +1 & +1 & -1 & -1 \\ +1 & -1 & -1 & +1 \end{bmatrix}$$

FIG 3



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	2101	2102	2103	2104	2105	2106	2107	2108	2109	2110	2111	2112	2113	2114	2115	2116	2117	2118	2119	2120	2121	2122	2123	2124	2125	2126	2127	2128	2129	2130	2131	2132	2133	2134	2135	2136	2137	2138	2139	2140	2141	2142	2143	2144	2145	2146	2147	2148	2149	2150	2151	2152	2153	2154	2155	2156	2157	2158	2159	2160	2161	2162	2163	2164	2165	2166	2167	2168	2169	2170	2171	2172	2173	2174	2175	2176	2177	2178	2179	2180	2181	2182	2183	2184	2185	2186	2187	2188	2189	2190	2191	2192	2193	2194	2195	2196	2197	2198	2199	2200	2201	2202	2203	2204	2205	2206	2207	2208	2209	2210	2211	2212	2213	2214	2215	2216	2217	2218	2219	2220	2221	2222	2223	2224	2225	2226	2227	2228	2229	2230	2231	2232	2233	2234	2235	2236	2237	2238	2239	2240	2241	2242	2243	2244	2245	2246	2247	2248	2249	2250	2251	2252	2253	2254	2255	2256	2257	2258	2259	2260	2261	2262	2263	2264	2265	2266	2267	2268	2269	2270	2271	2272	2273	2274	2275	2276	2277	2278	2279	2280	2281	2282	2283	2284	2285	2286	2287	2288	2289	2290	2291	2292	2293	2294	2295	2296	2297	2298	2299	2300	2301	2302	2303	2304	2305	2306	2307	2308	2309	2310	2311	2312	2313	2314	2315	2316	2317	2318	2319	2320	2321	2322	2323	2324	2325	2326	2327	2328	2329	2330	2331	2332	2333	2334	2335	2336	2337	2338	2339	2340	2341	2342	2343	2344	2345	2346	2347	2348	2349	2350	2351	2352	2353	2354	2355	2356	2357	2358	2359	2360	2361	2362	2363	2364	2365	2366	2367	2368	2369	2370	2371	2372	2373	2374	2375	2376	2377	2378	2379	2380	2381	2382	2383	2384	2385	2386	2387	2388	2389	2390	2391	2392	2393	2394	2395	2396	2397	2398	2399	2400	2401	2402	2403	2404	2405	2406	2407	2408	2409	2410	2411	2412	2413	2414	2415	2416	2417	2418	2419	2420	2421	2422	2423	2424	2425	2426	2427	2428	2429	2430	2431	2432	2433	2434	2435	2436	2437	2438	2439	2440	2441	2442	2
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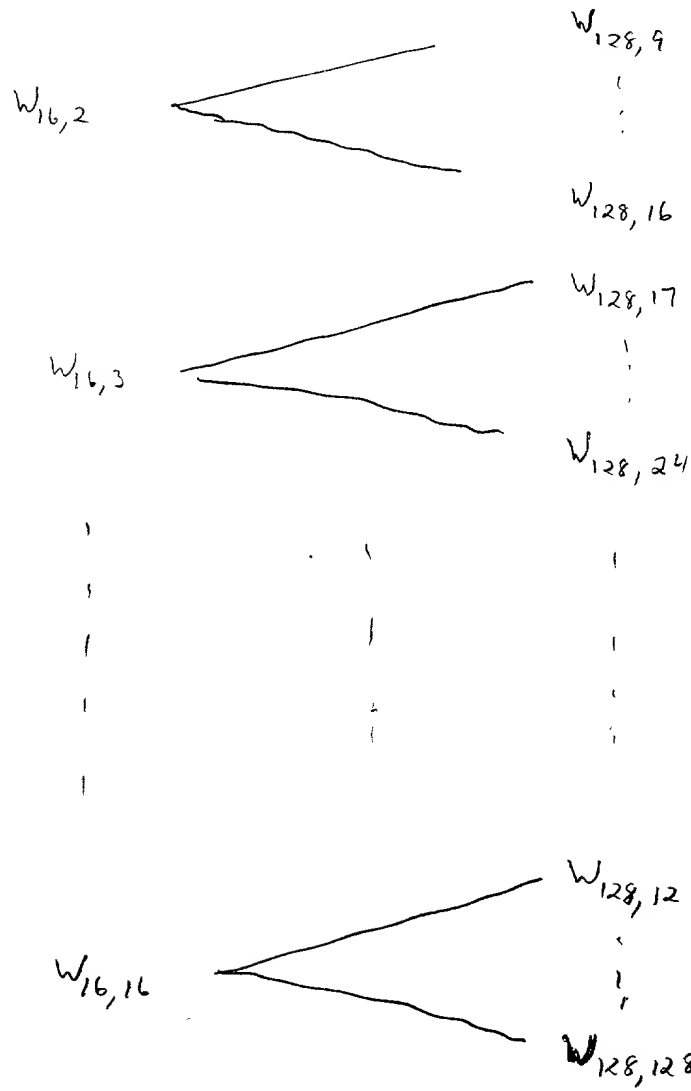
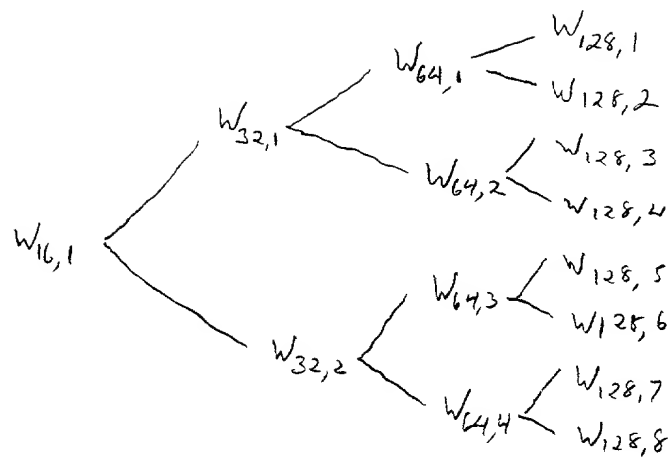


FIG 4

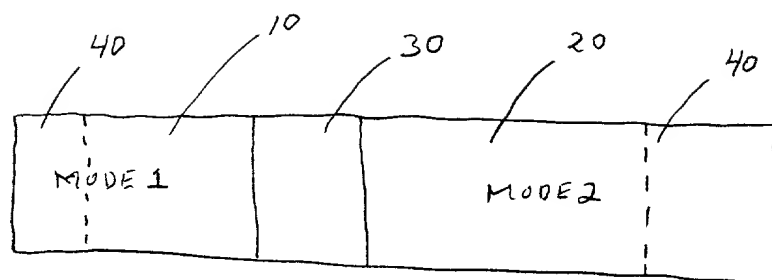


FIG 5

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Declaration and Power of Attorney

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am an original, first and sole inventor of the subject matter which is claimed and for which a patent is sought on the invention entitled **Code Space Sharing Among Multiple Modes Of Operation** the specification of which is attached hereto.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by an amendment, if any, specifically referred to in this oath or declaration.

I acknowledge the duty to disclose all information known to me which is material to patentability as defined in Title 37, Code of Federal Regulations, 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

None

I hereby claim the benefit under Title 35, United States Code, 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

None

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

I hereby appoint the following attorney(s) with full power of substitution and revocation, to prosecute said application, to make alterations and amendments therein, to receive the patent, and to transact all business in the Patent and Trademark Office connected therewith:

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